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THE GASTEROMYCETES OF AUSTRALASIA.

vii. The Genera Disciseda and Abstoma.

viii. The Genus Mycenastrum.

By G. H. Cunningham, Government Mycologist, Department of Agriculture, Wellington, N.Z.

(Plates xx-xxii.)

[Read 29th June, 1927.]

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In 1892 Morgan separated from *Bovista* species possessing a capillitium of free, short, simple fragments of hyphae and placed them in a genus he named *Catastoma*. In the type species of this genus, he noted that the stoma was at the base of the plant, and made this one of the chief characters of the genus. Since the publication of this paper many species have been recognized, and it is now known that the position of the stoma is of no generic value, for it may be apical or basal.

The genus was separated many years previously by Czernaiaiev (1845), who named it *Disciseda*, but his paper was overlooked until Hollos (1902), from a perusal of Morgan's paper was able to recognize the fact that *Catastoma* was the same as *Disciseda*. Lloyd in his publications has taken exception to the use of *Disciseda*, and throughout uses *Catastoma*, a name which is untenable according to the Rules of Nomenclature.

The species are all similar externally, and in consequence difficult of delimitation. This difficulty has been increased because many species have been named and imperfectly described from single specimens.

Lloyd (*Myc. Notes*, 1922, p. 1167) groups the species according to the colour of the gleba, but this is impracticable since in many the colour is not constant, different plants in the same collection, agreeing in all other respects, possessing an olivaceous, umber or purplish gleba (*D. candida*, *D. cervina* and *D. hyalothrix*).

After extended examination of the collections enumerated in this paper, the writer is of the opinion that two groups of characters alone, those of stoma and spores, may be used for the separation of the species.

The stoma may be a simple, plane, poorly defined aperture (*D. pedicellata*, *D. hyalothrix*); or may be conspicuous, mammose and fimbriate (*D. cervina*, *D. hypogaea*); lacerate and toothed (*D. verrucosa*); or definitely tubular and surrounded by a depressed groove (*D. anomala* and *D. australis*). As in old and weathered specimens these characters may be obliterated, the spore characters, which do not change with age, will be found to be more definite and accurate. The genus may in this manner be divided into pedicellate and apedicellate sections; and further separation may be effected according to the nature and to the degree of roughness of the spore-markings (see key).

Abstoma is separated because of the absence of a definite stoma, dehiscence being effected by the irregular rupture of the peridium. One other character of

interest in this genus is the fact that in the two species known, the spores are strongly reticulate.

Members of both genera consist of a peridium enclosing the gleba. The peridium consists of the usual two layers, exoperidium and endoperidium. The exoperidium is in most species in the nature of a membrane composed of hyphae and sand grains or vegetable debris immixed, forming a firm but brittle structure which may attain a thickness of 2-3 mm. or more. As the plant matures this usually fragments and falls away, save for a persistent discoid or cupulate basal portion. In some species the exoperidium is membranous.

The endoperidium is membranous or papyraceous, tough and usually polished, though in one or two species it is furfuraceous. It is perforated with a solitary apical or basal stoma. In one or two species a third delicate gelatinous and reticulate membrane is sometimes present lying between the layers of the peridium. As it may be present or absent on different plants of the same collection, it cannot be considered as being of specific value.

The gleba consists of capillitium and spores. It is usually pulverulent, but is compact in *Abstoma purpureum*. The threads are usually short, 50-100 μ or more, usually coloured, simple or short-branched, straight or more frequently curved, continuous and non-pitted. The spores are continuous, coloured, pedicellate or apedicellate, variously roughened, and usually globose. No sterile base or rooting base is present.

The habit is noteworthy, most species being hypogaean, growing solitary or in small groups in the ground, and becoming exposed as a rule only at maturity.

All descriptions are original and have been drawn up from specimens examined by the writer.

The writer is again indebted to Dr. J. B. Cleland, University, Adelaide, for the loan of all specimens in his possession.

Disciseda Czernaiaiev.

Bull. Soc. Imp. de Moscou, 1845, xviii, p. 153.—*Catastoma* Morgan, *Jour. Cin. Soc. Nat. Hist.*, 1892, xiv, p. 142.

Peridium depressed-globose, of two layers; an exoperidium which may be thick or thin, membranous, or compact when formed of hyphae immixed with sand particles or vegetable debris, fragile, breaking away irregularly, save a small discoid or cupulate basal portion; endoperidium papyraceous or membranous, tough, variously coloured, smooth or furfuraceous, dehiscing by a definite stoma, which may be apical or basal; sterile base absent.

Gleba pulverulent; capillitium of short, simple or short-branched, continuous, non-pitted coloured hyphae. Spores globose, coloured, variously roughened, pedicellate, apiculate or apedicellate.

Habitat:—Solitary or in small groups on or in the ground.

Distribution:—Europe; Asia; Africa; North and South America; Australia; New Zealand.

A small genus of about twelve species, eight of which occur in Australia and New Zealand.

Key to the species.

Spores long-pedicellate (10 μ or more).
Spores strongly verrucose, 8-10 μ diam. ..... 1. *D. pedicellata.*
Spores finely verrucose-areolate, 10-13 μ ..... 2. *D. hyalothrix.*

Spores apedicellate (or apiculate, stumps only of the pedicels persisting).
- Spores almost smooth ..... 3. *D. candida.*
- Spores finely verrucose.
  - Stoma fimbriate-mammose ..... 4. *D. cervina.*
  - Stoma tubular, surrounded by a depressed groove.
    - Spores finely verrucose-echinulate ..... 5. *D. anomala.*
    - Spores covered with fine round-topped warts ..... 6. *D. australis.*
- Spores coarsely verrucose.
  - Spores covered with flat-topped echinulae ..... 7. *D. hypogaea.*
  - Spores covered with coarse verrucae ..... 8. *D. verrucosa.*

1. Disciseda pedicellata (Morgan) Hollos. Plate xx, figs. 1, 2; Plate xxi, fig. 4.

Term. Feuz., xxv, 1902, p. 103.—*Catastoma pedicellata* Morg., *Jour. Cin. Soc. Nat. Hist.*, 1892, xiv, p. 143.

Peridium up to 3 cm. diam., depressed-globose or lenticular, attached by a small rooting base; exoperidium a thick sand-case, of hyphae and debris immixed, grey or brown, flaking away save a small discoid basal portion; endoperidium tough, membranous, chestnut brown or umber, smooth, shining, dehiscing by a small apical, plane stoma.

Gleba purplish, pulverulent; capillitium pallid chestnut, of the usual type. Spores globose, 8-10 μ diam. (including verrucae), pedicellate, pedicels up to 25 μ long, stout, tinted; epispore chestnut brown, coarsely and strongly verrucose or verrucose-echinulate.

Habitat:—Solitary on the ground.

Distribution:—North America; South Africa; Australia.

New South Wales:—*Sussex Island, Clarence River, Sept., 1909; *Narrabri, June, 1919 (Det. Lloyd No. 527 as *Catastoma pedicellata*).

South Australia:—*Yanco Area, Nov., 1919; *Pt. Elliot, Aug., 1918, D. I. Cleland; *Buckland Park, Apl., 1923; *Fullarton, Adelaide, May, 1923; *no locality, F. R. Zeitz.

The species is characterized by the (usually) large size, firm, leathery, umber, polished endoperidium, indefinite plane stoma, and especially by the long-pedicellate, coarsely roughened spores. The spore markings vary somewhat in different collections; in some being strongly verrucose, in others verrucose-echinulate. The length of the spines may vary from 1·5 μ to 0·5 μ. As all conditions may be noted in the same microscopic field, these variations cannot be considered of specific import.

This is one of the most abundant of the Australian species, judging from the collections in Dr. Cleland's possession, and is separated from *D. hyalothrix*, which it resembles in the pedicellate spores and plane stoma, by the smaller, more coarsely warted spores and longer pedicels.

2. Disciseda hyalothrix (Cooke and Massee) Hollos. Plate xxi, fig. 5.

Noev. Koezl., 1902, p. 107.—*Bovista hyalothrix* Cke. et Mass., *Grev.*, 1888, xvi, p. 73.—*Catastoma hyalothrix* (Cke. et Mass.) Lloyd, *Lyc. Aus.*, 1905, p. 27.

Peridium up to 2·5 cm. diam., depressed-globose; exoperidium in the nature of a sand-case, flaking away irregularly, save a small attached basal portion; endoperidium umber or purplish, smooth, tough, membranous, dehiscing by an irregular, plane, apical stoma.

* An asterisk denotes that the collection in question is in the herbarium of Dr. J. B. Cleland, Adelaide; and where no collector is given, signifies that the collection was made by Dr. Cleland himself.

Gleba dark olivaceous, becoming dark purple, pulverulent; capillitium threads tinted, of the usual type. Spores globose, 10-13 μ diam., pedicels short, up to 15 μ, stout, tinted; epispore deep chestnut brown, densely and finely covered with tinted or hyaline verrucae, which appear areolate in consequence of their close arrangement.

Habitat:—Solitary on the ground.

Distribution:—Australia.

Victoria:—Lake Allacutya, C. French. Type, in Herb. Kew.

New South Wales:—*Dubbo, June, July, Oct., 1915 (One collection det. by Lloyd No. 137 as *Catastoma hyalothrix*).

South Australia:—*Adelaide, July, 1914.

Characterized by the pedicellate, closely and densely verrucose spores. The verrucae are densely packed, and somewhat irregular in shape and size, consequently in surface view the epispore appears somewhat areolate. The plane stoma is also characteristic. The gleba may be purplish or olivaceous.

3. Disciseda candida (Schweinitz) Lloyd. Plate xx, figs. 3, 4; Plate xxi, fig. 7.

Mycological Notes, 1902, p. 100.—*Bovista candida* Schw., *Syn. Fung. Carol.*, No. 333, 1822.—*B. circumscissa* Berk. et Curt., *Grev.*, 1873, p. 50.—*Catastoma circumscissa* (Berk. et Curt.) Morg., *Jour. Cin. Soc. Nat. Hist.*, 1892, xiv, p. 143.—*Disciseda circumscissa* (Berk. et Curt.) Hollos, *Term. Feuz.*, 1902, xxv, p. 102.

Peridium up to 3 cm. diam., depressed-globose; exoperidium thick, firm, of hyphae and vegetable debris immixed, breaking away circumscissilely from the base; endoperidium ferruginous to umber, tough, covered in part by a reticulate, gelatinous layer; dehiscing by a basal, fimbriate, mammose stoma.

Gleba olivaceous, umber or purplish, pulverulent; capillitium threads pallid chestnut, of the usual type. Spores globose, 3·8-4·5 μ diam., with stumps only of the pedicels remaining; epispore pallid chestnut brown, very finely verruculose, almost smooth when × 1,000.

Habitat:—Solitary or in small groups in pastures; hypogaean.

Distribution:—Europe; North and South America; Australia; New Zealand.

New South Wales:—*Milson Island, Hawkesbury River, Feb., 1916 (two collections, both det. by Lloyd No. 139 as *Catastoma hyalothrix*).

New Zealand:—Roxburgh, Otago, Aug., 1925, J. C. Neill.

Characterized by the almost smooth spores, absence of a definite pedicel, and fimbriate, mammose stoma. According to Morgan the stoma is situated at the base of the plant.

The gleba is olivaceous when young, deep umber when old; frequently in Australian plants identical in all other respects, it is tinged with purple.

4. Disciseda cervina (Berkeley), n. comb. Plate xx, fig. 5; Plate xxii, fig. 1.

Bovista cervina Berk., *Ann. Mag. Nat. Hist.*, 1842, ix, p. 447.—*Globaria debreciensis* Hazsl., *Zoo. Bot. Ges.*, 1877, xxvi, p. 226.—*Bovista subterranea* Peck, *Bot. Gaz.*, 1879, iv, p. 216.—*B. argillacea* Pat., *Bull. Soc. Myc. Fr.*, 1888, p. 93.—*B. debreciensis* (Hazsl.) de Toni, in Sacc. *Syll. Fung.*, 1888, vii, p. 476.—*Catastoma subterranea* (Peck) Morg., *Jour. Cin. Soc. Nat. Hist.*, 1892, xiv, p. 143.—*C. debreciense* (Hazsl.) Hollos, *Term. Koezl.*, 1902, lvi, p. 186.—*Disciseda debreciensis* (Hazsl.) Hollos, *Term. Feuz.*, 1902, xxv, p. 102.

Peridium up to 4 cm. diam., depressed-globose; exoperidium thick, brittle, flaking away irregularly save at the base; endoperidium tough, membranous, purplish or tan coloured, furfuraceous, dehiscing by a fimbriate, mammose stoma.

Gleba olivaceous, umber or purplish; capillitium threads pallid chestnut brown, of the usual type. Spores globose, 5·5-6·5 μ diam., with stumps only of the pedicels remaining; epispore chestnut brown, closely and finely verruculose.

Habitat:—Solitary in the ground; hypogaean.

Distribution:—Europe; North America; Australia; New Zealand.

New South Wales:—*Forbes, Aug., 1915; *Merebine, Nov., 1918 (Det. Lloyd No. 508 as "near *Catastoma circumscissa*"); *near Barellan, Aug., 1918.

South Australia:—*Grange, July, 1914; *Monarto South, July, 1922 (Det. Lloyd No. 852 as *Catastoma subterranea*); *Ooldea, Aug., 1922.

New Zealand:—Roxburgh, Otago, Aug., 1925, J. C. Neill; Ashburton, Canterbury, Aug., 1925, J. C. Neill.

The species resembles the preceding in many characters, but may be separated by the larger and more definitely verruculose spores. The verrucae differ considerably in different collections, some being fine, approaching those of the former species (when the spore size alone separates them); others being coarse, approaching those of *D. anomala*. In such cases the nature of the stoma aids in separating the two.

Lloyd has examined the type of "*Bovista cervina*" and found it to be the same as "*Catastoma subterranea*". Therefore the specific name *cervina* has priority.

5. Disciseda anomala (Cooke and Massee) n. comb. Plate xx, figs. 6, 7; Plate xxi, fig. 9.

Bovista anomala Cke. et Mass., *Grev.*, 1889, xviii, p. 6.—*Catastoma anomalum* (Cke. et Mass.) Lloyd, *Lyc. Aus.*, 1905, p. 27.

Peridium up to 2 cm. diam., depressed-globose or pulvinate; exoperidium a thin brown membrane, flaking away save at the base where persisting as a small cupulate structure, externally covered with debris; endoperidium bay brown or umber, firm, membranous, furfuraceous, dehiscing by a raised, tubular, mammose, circular stoma which is surrounded by a depressed groove.

Gleba olivaceous, becoming umber, pulverulent; capillitium threads pallid chestnut brown, of the usual type. Spores globose, 6-8 μ diam., stumps only of the pedicels remaining; epispore pallid chestnut brown, finely and closely verruculose.

Habitat:—Solitary or in small groups on the ground.

Distribution:—Australia.

New South Wales:—*Milson Island, Hawkesbury River, Jan., 1915 (Det. Lloyd No. 76 as *Catastoma anomalum*); March, 1916; *Dubbo, June, 1915 (Det. Lloyd No. 78 as *Catastoma anomalum*); *Forbes, Aug., 1915 (Det. Lloyd No. 77 as *C. anomalum*).

Victoria:—*Ararat, July, 1918, E. J. Semmens.

South Australia:—*Ooldea, Aug., 1922 (2 collections).

Characterized by the thin and membranous exoperidium, finely verruculose spores and especially by the definite tubular stoma, surrounded by a depressed groove. The stoma is not always tubular, however, for sometimes it may be fimbriate and mammose, and in old and weathered specimens almost indefinite.

Sometimes a trace of a gelatinous membrane is present lying on the surface of the endoperidium. The gleba is frequently tinged with purple in old specimens.

6. DISCISEDA AUSTRALIS, n. sp. Plate xxi, figs. 1, 8.

Peridium up to 3 cm. diam., depressed-globose, attached by a small rooting base; exoperidium thin, umber, fragile, membranous, flaking away irregularly save at the base; endoperidium furfuraceous, dehiscing by a tubular or mammose stoma, which is surrounded by a depressed groove.

Gleba olivaceous, pulverulent; capillitium threads pallid chestnut brown, of the usual type. Spores globose or subglobose, 5-6·5 μ diam., with stumps only of the pedicels persisting; epispore pallid chestnut brown, closely and finely verruculose, warts round-topped.

Habitat:—Solitary on the ground.

Distribution:—Australia.

Victoria:—*Ararat, May, 1918, E. J. Semmens. Type, in Herb. Cleland.

South Australia:—*Mt. Pleasant, June, 1925.

The characters of the species are the membranous exoperidium, definite stoma of the *D. anomala* type, and the fine, closely grouped, round-topped warts covering the epispore. These, though readily seen when magnified × 1,000, are barely perceptible when × 500.

The plant has a general resemblance to the preceding, especially in the characters of the exoperidium and stoma; but may be separated by the different spores, larger peridium, and darker colour of the endoperidium.

7. DISCISEDA HYPOGAEA (Cooke and Massee) n. comb. Plate xxii, fig. 2.

Bovista hypogaea Cke. et Mass., *Grev.*, 1891, xx, p. 35.—*Catastoma hypogaeum* (Cke. et Mass.) Lloyd, *Lyc. Aus.*, 1905, p. 27.

Peridium up to 2 cm. diam., depressed-globose or subglobose; exoperidium membranous, very thin, pallid ochraceous, fragile, falling away irregularly save at the base; endoperidium thin, flaccid, papyraceous, olivaceous, furfuraceous, dehiscing by a minute mammose apical stoma.

Gleba olivaceous, pulverulent; capillitium of the usual type, tinted. Spores globose, 8-9 μ diam. (including verrucae), stumps only of the pedicels persisting; epispore chestnut brown, closely covered with coarse flat-topped echinulae.

Habitat:—Solitary in the ground; hypogaean.

Distribution:—Australia.

New South Wales:—*Narrabri, May, 1919.

The coarse, flat-topped spines of the spores characterize the species. These are so well marked as to form a definite halo around the spores when these are viewed in median section; resembling in this particular the spores of certain species of *Geaster*. The thin and flaccid nature of the exoperidium is also characteristic.

Lloyd (1905, p. 27) records the species as being collected in New Zealand by R. Brown; the writer has not seen New Zealand specimens.

8. DISCISEDA VERRUCOSA G. H. Cunn. Plate xxi, figs. 2, 6.

Trans. N.Z. Inst., 1926, lvii, p. 205.

Peridium up to 3 cm. diam., depressed-globose; exoperidium brown, tough, of hyphae and vegetable debris immixed, flaking away irregularly save a small persistent basal portion; endoperidium thick, tough, membranous, bay brown or tinged with purple, dehiscing by an irregularly torn, toothed apical stoma.

Gleba purplish, pulverulent; capillitium threads tinted, of the usual type. Spores globose, 6-8 μ diam. (including verrucae), stumps only of the pedicels

persisting; epispore chestnut brown, covered with coarse hyaline verrucae, often in the form of finger-like processes.

Habitat:—Solitary or in small groups on the ground.

Distribution:—Australia; New Zealand.

New Zealand:—Milford Track, Otago, Jan., 1920, E. H. Atkinson, Type, in the herbarium of the writer, No. 887; Waikare, Canterbury, Jan. 1926, G.H.C.

New South Wales:—*Forbes, Aug., 1915.

South Australia:—*Beaumont, May, 1922; *Flinders Range, near Pt. Augusta, Aug., 1922; *Kinchina, Aug., 1922 (2 collections); *Grange, June, 1925, Mr. Tee.

The species is characterized by the nature of the spores, these being covered with coarse, hyaline, finger-like processes. The latter vary in length, however, in some collections being about half the length of those present in others.

Doubtful and Little Known Species.

DISCISEDA MUELLERI (Berkeley) n. comb.

Bovista Muelleri Berk., *Proc. Linn. Soc. Bot.*, 1878, xvi, p. 171.—*Catastoma Muelleri* (Berk.) Lloyd, *Lyc. Aus.*, 1905, p. 27.

Peridium up to 2·5 cm. diam., subglobose, with a short, stout rooting base; exoperidium soon umber with minute, pale subpersistent warts; endoperidium firm, rather thick, brown.

Gleba reddish-brown, capillitium threads flaccid, pale, but little branched. Spores globose, 10-12 μ diam., apedicellate; epispore reddish-umber, coarsely spinulose.

Habitat:—On the ground.

Distribution:—Australia.

Queensland:—Herberts Creek, Darling Range. Type, in Herb. Kew.

The writer has not seen specimens; the description (slightly modified) being that given by Cooke in his *Handbook* (1892). The species is placed in the doubtful section, for the description of the spores is such that it is not possible to compare it with the others. According to Lloyd this has the roughest spores of any species included in the genus. In the description the gleba is said to be reddish-brown, and in fact this is the only character by which it can be said to differ from most others placed in the genus; but as has been shown, glebal colour is not of specific value.

A single broken specimen of some *Disciseda* in the possession of Dr. Cleland has a similar reddish-brown gleba, but the spores are much smaller than the measurements given for *D. Muelleri* and are angular and tuberculate-striate. The specimen is too broken to allow of its being described.

Lloyd (*Myc. Notes*, 1917, p. 631) describes a species under the name of *Catastoma magnum*, stated to have been collected in Canterbury. He considered it differed from *D. anomala* in the larger size, thick, leathery exoperidium and in the apedicellate, strongly roughened spores, but claimed it was but a form of *D. anomala*. From his description it is impossible to say to what species it should be referred. The same "species" has been recorded from South Africa by Verwoerd (1925).

ABSTOMA G. H. Cunn.

Trans. N.Z. Inst., 1926, lvii, p. 206.

Peridium subglobose, of two layers; a thick, fragile exoperidium composed of hyphae immixed with sand particles, breaking away irregularly; and a

papyraceous or membranous, coloured endoperidium which dehisces by irregular rupture, a stoma being absent.

Gleba of spores and capillitium, compact or pulverulent at maturity; capillitium threads short, occasionally branched, smooth, continuous, coloured. Spores apedicellate, globose, reticulate, coloured.

Habitat:—Solitary or in small groups in the ground; hypogaean.

Distribution:—Australia; New Zealand.

The genus is separated from the preceding because of the absence of a stoma, dehiscence being effected by the irregular breaking away of the peridium; in other characters, as habit, structure, capillitium, etc. it is practically identical. The spores, however, are characteristic in the two species described below in that they are reticulate, a condition not known to occur with any species of *Disciseda*.

1. ABSTOMA PURPUREUM (Lloyd) G. H. Cunn. Plate xxi, fig. 3; Plate xxii, fig. 4.

Trans. N.Z. Inst., 1926, lvii, p. 206.—*Catastoma purpurea* Lloyd, *Myc. Notes.* 1922, p. 1120.

Peridium up to 4 cm. diam., subglobose or depressed-globose; exoperidium a sand-case, up to 3 mm. thick, firm, brittle, dull purple, breaking away irregularly and completely; endoperidium thin, papyraceous, fragile, dark purple, almost black, free from the exoperidium save at the base where attached (but not organically); dehiscing by irregular rupture.

Gleba purple, firm and compact; capillitium threads deep chestnut brown, thick walled. Spores globose or shortly elliptical, 8-16·5 μ diam., apedicellate; epispore deep chestnut brown, closely and finely reticulate.

Habitat:—In sand among dunes; hypogaean.

Distribution:—New Zealand.

Weraroa, Wellington, Nov., 1919, S. A. Cunningham, E. H. Atkinson, G.H.C. Type collections, and type of the genus, in the herbarium of the writer, No. 1783.

The species is characterized by the purple colour of the whole plant, the thick sand-case exoperidium, fragile, non-stomate endoperidium, and deeply coloured, reticulate spores.

The habit is peculiar. The plant grows buried to a depth of several centimetres, 7-10 or more, in sand at Weraroa beach. When wind erosion occurs, as is frequent in this area of shifting dunes, the sand is blown for some distance, large amphitheatres being formed, and the globose plants are carried by the wind often for one kilometre or more from their place of origin. They are rolled along the surface of the dune slopes and finally arrested by debris of the nature of branches of trees and stumps half buried at the tops of the long dune slopes. Here they come to rest and the peridium is gradually removed by friction of the sand particles.

2. ABSTOMA RETICULATUM, n. sp. Plate xxii, fig. 3.

Peridium up to 3 cm. diam., depressed-globose; exoperidium of the nature of a fugacious sand-case; endoperidium umber or sepia brown, tough, membranous, smooth, dehiscing by irregular rupture.

Gleba olivaceous, pulverulent; capillitium threads tinted, thin walled. Spores globose, 8-12 μ diam., apedicellate; epispore coarsely and strongly reticulate, chestnut brown.

Habitat:—Solitary on the ground; hypogaean?

Distribution:—Australia.

New South Wales:—*Forbes, Aug., 1915, J. B. Cleland. Type, in Herb. Cleland.

The olivaceous colour of the gleba, tough and membranous endoperidium, and coarsely reticulate spores separate the species from the preceding. The exoperidium has almost completely disappeared from this collection.

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Synonyms are in italics.

Abstoma G. H. Cunn.
- purpureum (Lloyd) G. H. Cunn.
- reticulatum G. H. Cunn.

Bovista anomala Cke. et Mass.
- *argillacea* Pat.
- *candida* Schw.
- *cervina* Berk.
- *circumscissa* Berk. et Curt.
- *debreciensis* (Hazsl.) de Toni
- *hyalothrix* Cke. et Mass.
- *hypogaea* Cke. et Mass.
- *Muelleri* Berk.
- *subterranea* Peck

Catastoma Morg.
- *anomalum* (Cke. et Mass.) Lloyd
- *circumscissa* (Berk. et Curt.) Morg.
- *debreciense* (Hazsl.) Hollos
- *hyalothrix* (Cke. et Mass.) Lloyd
- *hypogaeum* (Cke. et Mass.) Lloyd
- *magnum* Lloyd

Catastoma Morg. (*continued*)
- *Muelleri* (Berk.) Lloyd
- *pedicellata* Morg.
- *purpurea* Lloyd
- *subterranea* (Peck) Morg.

Disciseda Czern.
- Key to species (p. 236)
- anomala (Cke. et Mass) G. H. Cunn.
- australis G. H. Cunn.
- candida (Berk.) Lloyd
- cervina (Berk.) G. H. Cunn.
- *circumscissa* (Berk. et Curt.) Hollos
- *debreciensis* (Hazsl.) Hollos
- hyalothrix (Cke. et Mass.) Hollos
- hypogaea (Cke. et Mass.) G. H. Cunn.
- Muelleri (Berk.) G. H. Cunn.
- pedicellata (Morg.) Hollos
- verrucosa G. H. Cunn.

Globaria debreciensis Hazsl.

EXPLANATION OF PLATES XX-XXII.

Plate xx.

Fig. 1. *Disciseda pedicellata*, natural size. The upper plant is reversed to show the persistent basal portion of the exoperidium.

Fig. 2. *D. pedicellata*, × 2. Showing the plane stoma and the smooth endoperidium.

Fig. 3. *D. candida*, natural size. Note the large mammose stoma.

Fig. 4. *D. candida*, × 3. Showing the furfuraceous endoperidium, persistent basal portion of the exoperidium and the fimbriate mammose stoma.

Fig. 5. *D. cervina*, natural size. Note the mammose stoma and persistent basal portion of the exoperidium.

Fig. 6. *D. anomala*, natural size.

Fig. 7. *D. anomala*, × 3·5. Note the tubular mammose stoma surrounded by a depressed ring.

Plate xxi.

Fig. 1. *D. australis*, natural size.
Fig. 2. *D. verrucosa*, natural size.
Fig. 3. *Abstoma purpureum*, natural size.
Fig. 4. *Disciseda pedicellata*, spores, × 1200.
Fig. 5. *D. hyalothrix*, spores, × 1200.
Fig. 6. *D. verrucosa*, spores, × 1200.
Fig. 7. *D. candida*, spores, × 1200.
Fig. 8. *D. australis*, spores, × 1200.
Fig. 9. *D. anomala*, spores, × 1200.

Plate xxii.

Fig. 1. *Disciseda cervina*, spores, × 1200.
Fig. 2. *D. hypogaea*, spores, × 1200.
Fig. 3. *Abstoma reticulatum*, spores, × 1200.
Fig. 4. *A. purpureum*, spores, × 1200.

All photographs (except Plate xxi, fig. 3, by H. Drake) have been taken by the writer. The spore drawings have been made with the aid of a camera lucida; × 1200.

THE GASTEROMYCETES OF AUSTRALASIA.

viii. The Genus Mycenastrum.

(Plate xxii, figs. 5-8.)

This genus contains a single species, which has been collected in practically every country in the world, though it is most abundant in sandy regions.

The peridium ranges in size from 2 cm. to 20 cm. or more, and may be globose, obovate or pyriform. It consists of the usual two tissues, exoperidium and endoperidium.

The exoperidium is thin, floccose and usually smooth externally, but forms occur in which the flocci are aggregated into definite scales; at maturity it usually falls away completely, exposing the endoperidium. This latter tissue is unlike that of the other genera of this sub-family in that it is thick, 2-5 mm., and indurated. In young plants it may appear almost cartilaginous, but in mature plants it is hard and coriaceous, or even corky.

The peridium may dehisce in a stellate manner, or by the falling away in irregular flakes from the apical portion.

The gleba consists of spores and capillitium, and is decidedly pulverulent at maturity. The capillitium threads are peculiar and characteristic. Each consists of a short main stem which may be simple or short-branched, and is covered with short, acuminately pointed spines. These threads differ considerably, even in the same plant, in the degree of spininess, shape and size. Mixed with the capillitium threads are usually present numerous long and unbranched septate hyphae of a type similar to those forming the peridium.

Mycenastrum Desvaux.

Ann. Sci. Nat., 2, 1842, xvii, p. 143.—*Pachyderma* Schulz., *Verh. Zoo. Bot. Ges. Wien.*, 1875, xxv, p. 79.

Peridium globose, obovate or pyriform, of two layers; a thin, floccose exoperidium; and a thick, indurated, persistent endoperidium; dehiscing in a stellate manner, or by the irregular rupture of the apical portion; sterile base absent.

Gleba olivaceous, becoming umber, pulverulent; capillitium threads very abundant, of numerous short hyphae, continuous, short-branched or simple, branches beset with stout, spinous processes. Spores globose or elliptical, coloured, coarsely echinulate.

Habitat:—Solitary, in small groups or caespitose on the ground; epigaean.

Distribution:—Europe; North America; Asia; India; Africa; Australia; New Zealand.

The genus is characterized by the nature of the capillitium, the hard and coriaceous endoperidium and the method of dehiscence.

Mycenastrum corium (Guersent) Desvaux. Plate xxii, figs. 5-8.

Ann. Sci. Nat., 1842, xvii, p. 147.—*Lycoperdon corium* Guers., in DC. *Fl. Fr.*, suppl. 2, 1815, p. 598. *Bovista suberosa* Fr., *Syst. Myc.*, iii, 1829, p. 26. *Scleroderma*

corium Grev., in Duby *Bot. Gall.*, ii, 1830, p. 892. *Mycenastrum phaeotrichum* Berk. in Hook. *Lond. Jour. Bot.*, ii, 1843, p. 418. *M. chilense* Mont., *Ann. Sci. Nat.*, ser. 2, xx, 1843, p. 375. *Endoneuron suberosum* Czern., *Bull. Soc. Imp. Mosc.*, xviii, 1845, p. 152. *Mycenastrum leptodermeum* Dur., *Fl. Alg.*, 1849, p. 386. *M. radicatum* Dur., *l.c.*, p. 387. *M. Beccarii* Pass., *Nuov. Giorn.*, vii, 1875, p. 183. *Pachyderma Strossmayeri* Schulz., *Verh. Zoo. Bot. Ges. Wien*, xxv, 1875, p. 79. *Mycenastrum clausum* Schulz., *Ibid.*, xxvii, 1877, p. 114. *Bovista spinulosa* Peck, *Bot. Gaz.*, iii, 1879, p. 170. *Mycenastrum spinulosum* Peck, *Thirty-Third Rept. for* 1879, 1883, p. 15. *M. olivaceum* Cke. et Mass., *Grev.*, xvi, 1887, p. 33. *Scleroderma phaeotrichum* (Berk.), de Toni, in Sacc. *Syll. Fung.* vii, 1888, p. 139. *S. chilense* (Mont.) de Toni, *l.c.* *S. spinulosum* (Peck) de Toni, *l.c.* *S. radicatum* (Dur.) de Toni, *l.c.* *S. leptodermeum* (D. et M.) de Toni, *l.c.* *S. Beccarii* (Pass.) de Toni, *l.c.* *S. olivaceum* (Cke. et Mass.) de Toni, *l.c.*

Peridium globose, subglobose, obovate or pyriform, up to 20 cm. diam.; exoperidium tomentose, fugacious, greyish; endoperidium thick, 2-5 mm., smooth, polished, at first greyish. becoming bay brown, dehiscing in a stellate manner, or by the irregular falling away of the apical portion.

Gleba olivaceous, becoming umber, pulverulent; capillitium threads of the usual type. Spores globose or shortly elliptical, 11-13 μ diam., apedicellate; epispore chestnut brown, densely echinulate, reticulate, wall 2 μ thick.

Habitat:—Solitary, in groups or caespitose on the ground.

Distribution:—Same as that of the genus.

Queensland:—*Barron Falls, Kuranda, Sept., 1917.

South Australia:—*Glen Osmond, Dec., 1920; *Adelaide, Oct., 1922; Feb., 1921; *Encounter Bay, Jan., 1924; *Pt. Elliot, Aug., 1918, D. I. Cleland.

Western Australia:—*Kalgoorlie, June, 1916.

New South Wales:—*Dungog, Nov., 1916; *Moore Park, Sydney, Dec., 1917; *Mudgee, Dec., 1917; *Cowra Experimental Farm, Dec., 1917; *Coolamon, May, 1918; *Narrabri, June, 1919.

New Zealand:—Castlepoint, Wairarapa, Jan., 1923, Miss Edwin; Spring Creek, Blenheim, Jan., 1925, W. D. Reid; Levels, Canterbury, Jan., 1927, G.H.C.

The species varies greatly in the size of the peridium, degree of spininess of the capillitium, roughness of the spores, and colour of the gleba. Usually if plants are collected and dried when young the gleba appears olivaceous; if dried when mature it may be umber or even purple.

Caespitose plants are frequent, at least in Australia and New Zealand. Plants break away from the point of attachment at maturity and are then often carried for considerable distances by wind, being rolled along the ground, and in this manner the spores are widely dispersed.

EXPLANATION OF PLATE XXII.

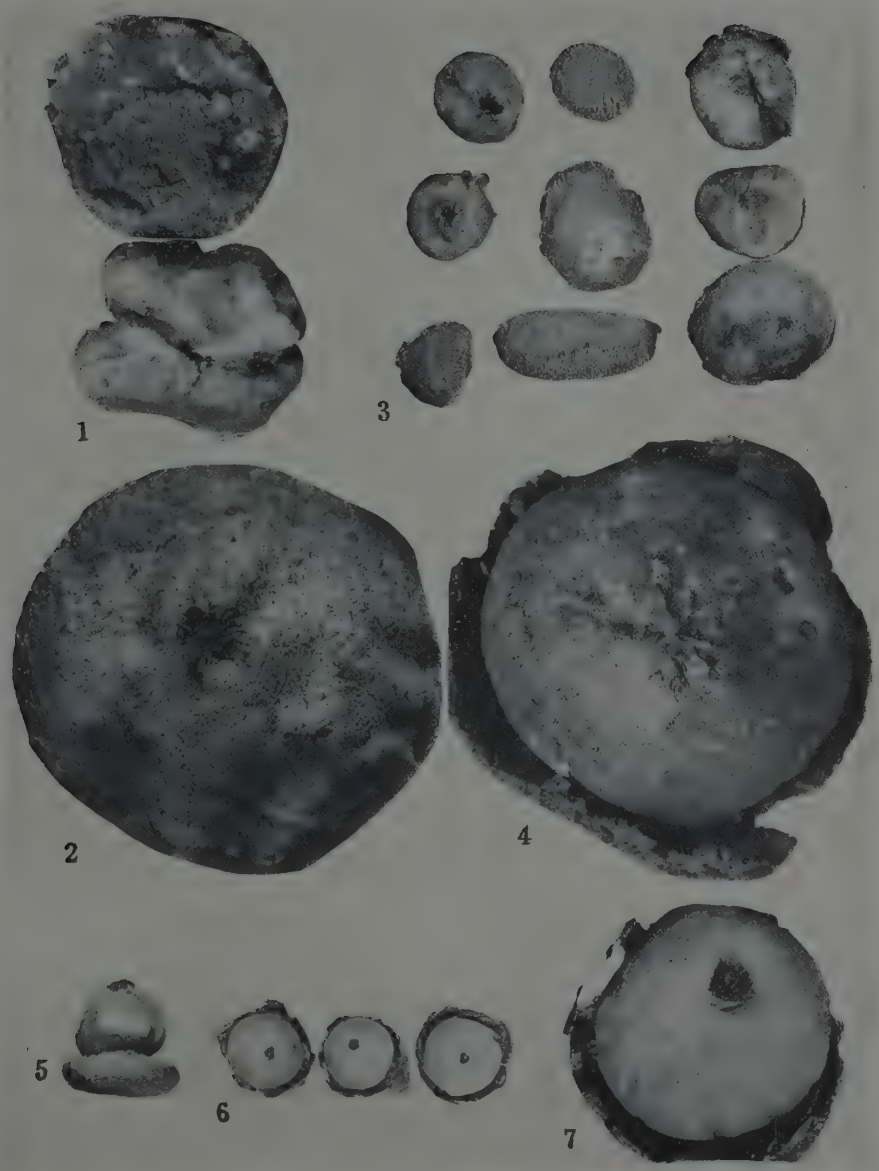
Fig. 5. *Mycenastrum corium.* × ⅔. Showing the thick endoperidium and the stellate method of dehiscence. (Photo. H. Drake.)

Fig. 6. *M. corium.* × ½. Showing the flaking exoperidium. (Photo. by writer.)

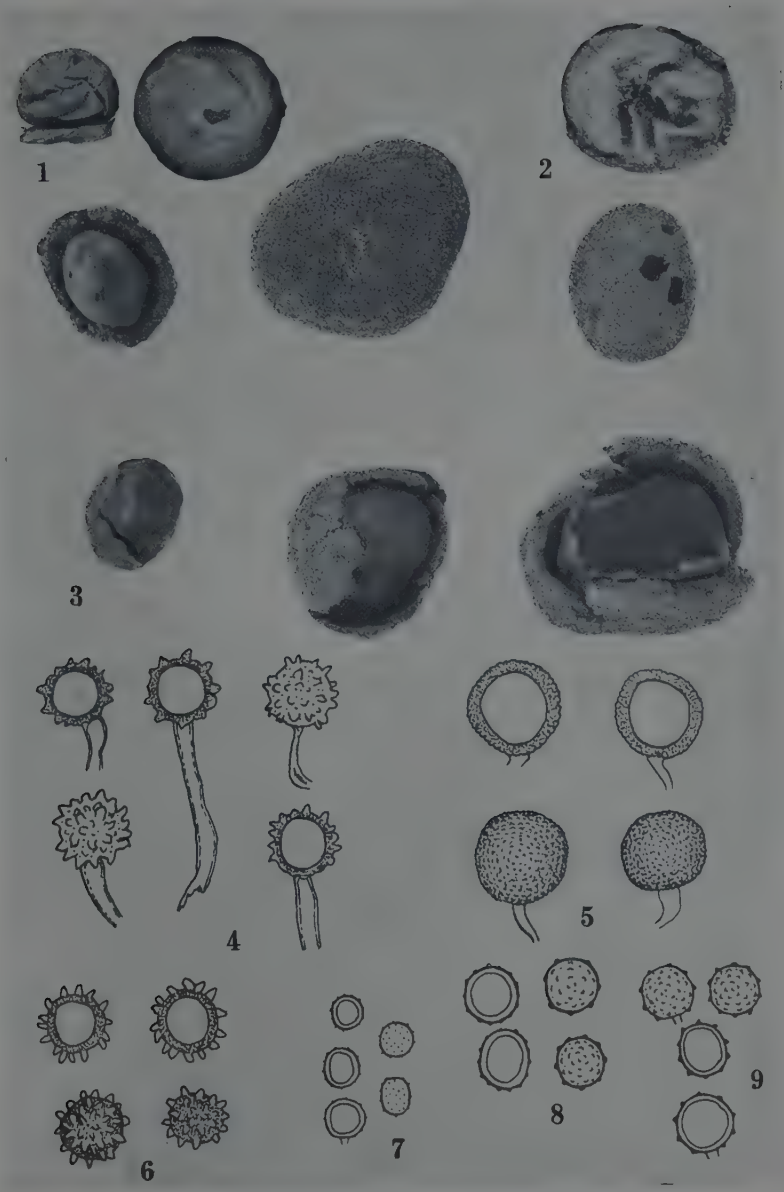
Fig. 7. Capillitium. × 125. Showing the spinose nature of the threads; air bubbles in the lumen of the threads show dark in this photo. (Photomicrograph by writer.)

Fig. 8. Spores. × 1200. Drawn from a lactic acid mount with the aid of a camera lucida; New Zealand form. The spines are somewhat exaggerated.

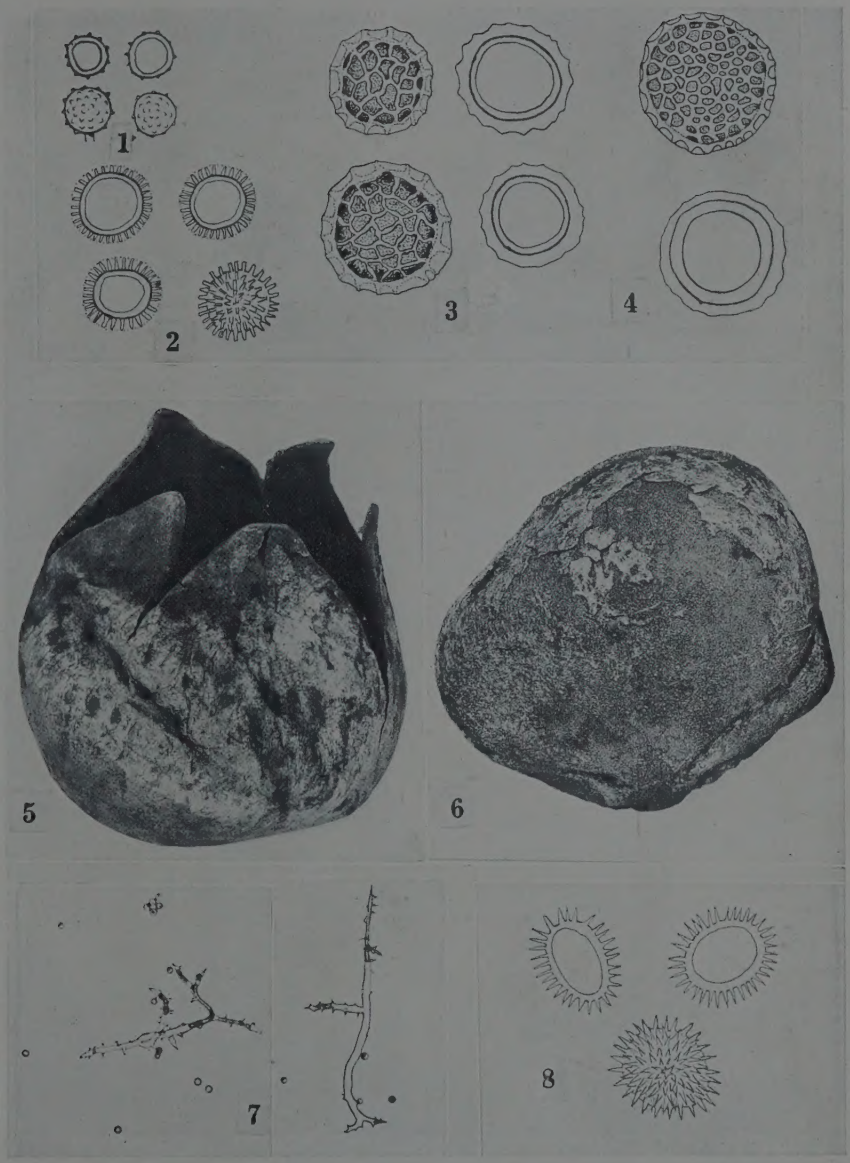
* Collections in the herbarium of Dr. J. B. Cleland, Adelaide University.



Australasian species of *Disciseda*.



Australasian species of *Disciseda* and *Abstoma*. Spores of *Disciseda*.



Mycenastrum corium. Spores of *Disciseda*, *Abstoma* and *Mycenastrum*.